# Before the FEDERAL COM MUNICATIONS COMMISSION Washington, D.C. 20554

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In the Matter of	)	
Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands	)	IB Docket No. 02-10
	)	

## OPPOSITION AND COMMENTS OF INTELSAT, LTD.

Phillip L. Spector Executive Vice President and General Counsel Intelsat, Ltd. Wellesley House North, 2nd Floor 90 Pitts Bay Road Pembroke, HM 08 Bermuda 441-294-1650 Susan H. Crandall Assistant General Counsel Intelsat Global Service Corporation 3400 International Drive, N.W. Washington, D.C. 20008 202-944-6800

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#### **SUMMARY**

The Commission's rules for operation of Earth Stations on Vessels ("ESVs") strike an appropriate balance between the interests of ESV and fixed service ("FS") operators. The Commission should therefore deny the request of the Fixed Wireless Communications Coalition ("FWCC") to tighten constraints on, or even to eliminate, operation of C-band ESVs in U.S. waters. In its petition for reconsideration of these rules, the FWCC attempts to paint a dire picture of the impact on FS operation of the framework adopted by the Commission. The FWCC's analysis, however, is based on a misleading characterization of the coordination process, and seriously underestimates the efficiencies that can be achieved in coordination between FS and satellite earth station operations. The FWCC's proposals would unnecessarily constrain ESV operations, and upset the balance achieved by the Commission.

The Commission's ESV rules generally address well the protection requirements of adjacent fixed-satellite service ("FSS") satellites. However, as the Commission emphasizes, important goals of this proceeding are to facilitate flexible ESV service, encourage technical innovation, and provide simple service rules. Intelsat supports various requests for reconsideration or clarification that would eliminate arbitrary disparities in the services that can be offered by ESV operators, and increase flexibility in the design and operation of ESV terminals, while continuing to provide adequate protection to FSS (and FS) operations.

In particular, Intelsat agrees with Boeing that the Commission should permits ESVs to operate at off-axis power levels greater than the limits adopted by the

Commission, if the levels are consistent with the coordinated parameters of the serving satellite. The Commission's limits are based on the requirements for operation in a two-degree spacing environment, and are unnecessarily overly-constraining in the more liberal spacing environments in much of the rest of the world. So long as appropriate showings are made of compliance with the coordinated parameters of the satellite, Boeing's proposal would cause no harm to adjacent satellite operations and would provide ESV operators with greater operational flexibility. The Commission's requirement that its adopted levels be met by all U.S.-licensed ESV operations, anywhere in the world, creates a regulatory disparity that serves no technical purpose, and penalizes U.S.-licensed operations.

Intelsat opposes PanAmSat's proposals to eliminate the off-axis EIRP density limits in favor of separate limits on antenna performance and input power, and to reinterpret the limits to include the effects of mispointing, both of which would lead to unnecessary constraints on ESV systems. However, Intelsat urges the Commission to consider modifications to the off-axis EIRP limits that would increase flexibility for ESVs without violating FSS protection requirements. In particular, the Commission should consider incorporating in the rules for ESVs certain approaches it has very recently embraced in the *Part 25 Streamlining* proceeding. The modifications described herein would provide further consistency with standards being adopted in that proceeding, and Intelsat urges to the Commission to apply them to ESVs in an appropriate manner, in this or another proceeding.

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### OPPOSITION AND COMMENTS OF INTELSAT, LTD.

Intelsat, Ltd. ("Intelsat") hereby opposes the petition for reconsideration of the Report and Order<sup>1</sup> in the above-captioned proceeding filed by the Fixed Wireless Communications Coalition ("FWCC").<sup>2</sup> Intelsat also opposes certain of the proposals filed by PanAmSat Corporation ("PanAmSat") and ARINC Incorporated ("ARINC").<sup>3</sup> Intelsat supports other requests filed by PanAmSat, The Boeing Company ("Boeing") and Maritime Telecommunications Network, Inc. ("MTN"), as identified below.<sup>4</sup>

Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands, Report and Order, IB Docket No. 02-10, FCC 04-286, rel. Jan. 6, 2005 (the "ESV Order").

Petition for Reconsideration of the Fixed Wireless Communications Coalition, IB Docket No. 02-10, March 2, 2005 ("FWCC Petition").

Petition of PanAmSat Corporation for Reconsideration or Clarification, IB Docket No. 02-10, March 2, 2005 ("PanAmSat Petition"); ARINC Incorporated Petition for Reconsideration, IB Docket No. 02-10, March 2, 2005 ("ARINC Petition").

Petition for Partial Clarification or Reconsideration of The Boeing Company, IB Docket No. 02-10, March 3, 2005 (revised copy) ("Boeing Petition"); Petition for Clarification and/or Partial Reconsideration of Maritime Telecommunications Network, Inc., IB Docket No. 02-10, March 2, 2005 ("MTN Petition").

In the *ESV Order*, the Commission established licensing and service rules for Earth Stations on Vessels ("ESVs") in the C-band and Ku-band, carefully tailored to permit introduction of ESVs while protecting fixed service ("FS"), fixed-satellite service ("FSS"), and certain government networks operating in the same bands. The Commission's rules strike an appropriate balance between the interests of ESV and FS operators. The proposals contained in the FWCC Petition, which are based on an overly-pessimistic characterization of the efficiencies that can be achieved in coordination, would seriously and unnecessarily harm ESV operations, and upset the balance achieved by the Commission.

The Commission's rules also generally address well the protection requirements of adjacent FSS satellites. However, as the Commission emphasizes, important goals of this proceeding are to facilitate flexible ESV service, encourage technical innovation, and provide simple service rules. Intelsat supports various requests for reconsideration or clarification proposed by Boeing, PanAmSat, and MTN that would better achieve these goals. The proposals supported by Intelsat below would eliminate arbitrary disparities in the services that can be offered by ESV operators, and increase flexibility in the design and operation of ESV terminals, while continuing to provide adequate protection to FSS (or FS) operations.

<sup>&</sup>lt;sup>5</sup> See, e.g., ESV Order, ¶¶ 4, 14.

## I. THE COMMISSION SHOULD DENY THE REQUESTS FOR RECONSIDERATION MADE BY THE FWCC.

The FWCC argues that the regime developed by the Commission fails to provide adequate protection to C-band FS services.<sup>6</sup> For the reasons below, the Commission should reject the FWCC's attempt to reopen issues that were studied comprehensively in this proceeding and decided in the *ESV Order*.

## A. The FWCC Exaggerates the Impact on the FS of Coordination of ESV Operations in the C-band.

To permit operation of ESV in the C-band, the FCC adopted a coordination approach, pursuant to which FS and ESV operators must coordinate new communications links with existing links on a first-come, first-served basis. In addition, to further guarantee availability of spectrum for new FS links, the Commission adopted power limits (toward the horizon) and a set of spectrum/satellite limits that apply to ESV operators.

The FWCC seriously under-represents the protection afforded to FS by these rules. First, it is not the case, as the FWCC suggests, that "licensed incumbents" will be unprotected or otherwise "asked to accept deleterious changes." Under the adopted coordination procedures, new ESV entrants are required to protect these existing licensed facilities.

<sup>&</sup>lt;sup>6</sup> FWCC Petition at 2.

ESV Order,  $\P$  20.

<sup>&</sup>lt;sup>8</sup> Id., ¶¶ 39-40, 45. A minimum elevation angle of 5° already applies to all FSS earth stations, including ESV antennas. 47 C.F.R. § 25.205.

<sup>&</sup>lt;sup>9</sup> FWCC Petition at 5.

More importantly, the FWCC grossly exaggerates the impact ESV coordination will have on FS expansion under the new rules. The FWCC attempts to paint a dire picture, starting with the incorrect premise that "[w]hen an ESV coordinates, it 'sterlizes' the coordinated frequencies against FS use over a wide geographic area." This is simply not the case. The FWCC's argument inexplicably ignores the role of coordination, which takes into account the directionality of both the FS and ESV signals to allow use of a given band of spectrum for multiple communications links. Contrary to the FWCC's claim, when an ESV coordinates, it *avoids* sterilizing the band.

Under the Commission's rules, each ESV operator is entitled to coordinate uplinks to up to two specific satellites only, in any given coordination location. <sup>11</sup>

Therefore, all coordinated ESV links will be directional, and coordination of a later cofrequency FS link in the vicinity can take advantage of this directionality. <sup>12</sup> In this way, spectrum coordinated by an ESV operator is *not* rendered unusable, as the FWCC claims.

<sup>10</sup> FWCC Petition at 10.

<sup>11</sup> ESV Order, ¶ 39. See also infra Section II.B.

The pointing direction of an ESV link will shift as a vessel moves, but not significantly over the distance of a coordination area.

Coordination also takes into account the actual locations of the transmitting and receiving stations, and is generally easier the greater the distance between the coordinated stations. In this case, the movement of a vessel with an ESV will affect the distance between that ESV and any FS stations near the vessel's path. However, it is still the case that, at any point along the path, the pointing angle for the ESV does not change significantly (within a given coordination area). Therefore, while vessel movement does complicate the coordination computations, and a moving ESV uplink may impact a greater geographical area than a fixed uplink, the directionality of the ESV signal still ensures that the link does not render unusable the band in which it operates.

The FWCC's entire analysis – in which it attempts to show that half the FS spectrum could be rendered "unusable" by a single ESV operator, <sup>13</sup> and that three-quarters of the FS spectrum could be tied up by ESV operators collectively <sup>14</sup> – depends on this erroneous assumption that spectrum is "sterilized" by coordination and cannot be further used for FS operations. For this reason, the FWCC's claim that the Commission's coordination provisions would allow "wholesale blockage" of spectrum must be rejected out of hand.

B. The Commission Should Not Tighten its Spectrum and Satellite Limitations Governing the Amount of Spectrum That Can Be Coordinated by ESV Operators.

As noted above, the Commission has imposed strict limits on the amount of spectrum that can be coordinated by ESV operators. Each ESV operator can coordinate no more than 36 MHz for uplink on each of no more than two satellites, and ESV operators collectively can coordinate no more than 180 MHz in a given location. These coordination limits go far beyond the rights generally granted a service in a typical coordination environment, and offer FS operators even more protection from ESVs than they receive from other FSS operations in the same band. 17

<sup>&</sup>lt;sup>13</sup> FWCC Petition at 12.

<sup>&</sup>lt;sup>14</sup> *Id.* at 13.

<sup>&</sup>lt;sup>15</sup> *Id*.

<sup>&</sup>lt;sup>16</sup> ESV Order, ¶¶ 39-40.

Id., ¶ 44. See also Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands, Notice of Proposed Rulemaking, IB Docket No. 02-10, FCC 03-286, rel. Nov. 24, 2005 (the "ESV NPRM"), ¶ 72.

Nevertheless, the FWCC seeks tightening of both of these rules to further favor FS operators. The FWCC now argues that mismatches between satellite transponders and FS channel allocations, and pairing of spectrum of FS channels to provide both a forward and return path, may affect the ability of an FS operator to use other, uncoordinated portions of the spectrum, even if those other portions would not receive any interference from ESV operations. The FWCC requests that such considerations be taken into account when evaluating compliance with the coordination limits. <sup>18</sup> The Commission should reject this argument, for several reasons.

First, the impact of C-band ESV links on FS operations was exhaustively studied, taking into account both FS and ESV operational requirements.<sup>19</sup> The difference in bandwidth between ESV and FS channels, and the common use of paired channels by FS operators, is well-known, and is not at all unique to this coordination scenario. The FWCC's new arguments in no way undermine the analysis on which the Commission's rules were based.

Furthermore, limiting the application of the rules to the amount of coordinated spectrum is a fair approach, as both FS and ESV operators can be affected by

Specifically, the FWCC requests that: "(1) The rule permitting an ESV provider to coordinate, at each location, a maximum 36 MHz on each of two satellites should provide further that the coordination may not encumber more than two 30 MHz FS channel pairs. (2) The rule limiting collective coordination to 180 MHz should provide further that spectrum coordinated on only one side of an FS frequency pair counts twice against the maximum . . ., and that the collective coordination may not encumber more than three 30 MHz FS channel pairs. (3) The rule limiting spectrum actually encumbered on an FS link to 180 MHz likewise should count both sides of the frequency pair and not encumber more than three 30 MHz channel pairs." FWCC Petition at 2-4.

<sup>&</sup>lt;sup>19</sup> See, e.g., ESV Order, ¶¶ 7-11; ESV NPRM, ¶¶ 12-15.

the types of secondary considerations raised by the FWCC, depending on the circumstances. For example, the mismatch in the bandwidth and overlap of the channels cited by the FWCC can also place constraints on an ESV operator seeking coordination with existing FS facilities.<sup>20</sup> In addition, just as a new ESV operation may place limits on new FS links, in both the forward and return paths, each of the forward and return paths of a single FS link will place a separate constraint on ESV use of the bands. Simply put, the FWCC's considerations can cut both ways. And the impact, if any, depends significantly on the specific circumstances of the case at hand.

More importantly, these considerations do not alter the Commission's analysis, or its conclusion that the limits sufficiently protect FS operations.<sup>21</sup> The Commission has consistently described its approach as placing a limit on the amount of spectrum that can be *coordinated for use by an ESV*, and not as a limit on the impact, whether direct or indirect, of that coordination on FS operations.<sup>22</sup> As noted above,

Even though the bandwidth of the FS channels may be smaller than the bandwidth of the ESV uplink channels, a single FS channel can still overlap two ESV uplink channels, affecting both. This is well-illustrated in the chart contained in the Appendix to the FWCC Petition, where it can be seen that many of the nominal 30 MHz FS channels overlap more than one satellite transponder allocation. It is important to note, however, that this is not an issue for either service in many cases, given the ability to coordinate co-frequency spectrum, and given the fact that partial channels are often used, decreasing the incidence of overlap.

<sup>&</sup>lt;sup>21</sup> ESV Order, ¶ 42.

<sup>&</sup>lt;sup>22</sup> ESV Order, ¶ 39; ESV NPRM, ¶¶ 69, 72. The spectrum limitation was based on a similar limitation in the "CSAT" rules. In that context as well it is clear that the limitation was developed to govern the amount of coordinated spectrum, and did not take into account other impacts. See ESV Order, ¶39 n.112.

Given this clear history, the apparent motivation for the FWCC's new argument for counting un-coordinated spectrum toward the limits is a statement in the ESV Order indicating that the 180 MHz limit applies to the amount of spectrum "actually encumbered by ESV operations in an FS link path." ESV Order, ¶ 40; FWCC Petition at 2. However, the sole example cited by

because coordination does not render the coordinated spectrum "unusable," as the FWCC claims, that impact is, in fact, very difficult to quantify (although it is certainly much less than that claimed by the FWCC). Moreover, the 72 MHz limit (36 MHz on each of two satellites) applicable to each ESV user was determined by the Commission to correspond to "current ESV network use and reflects the bandwidth of a full C-band satellite transponder." Tightening that limit would unduly constrain ESV operators, without any demonstrable benefit to the FS.

Finally, the Commission's spectrum/satellite limits do not purport to reserve any particular amount of spectrum for FS.<sup>24</sup> As noted above, in a coordination regime there is no need to do so, because multiple co-frequency links can co-exist.

Rather, the Commission's stated goal was to more generally ensure that spectrum would

the Commission to explain the need for this clarification (an example involving an FS link between two waterway locations, each of which involves separate coordination agreements) concerns only spectrum that is *actually coordinated* for use by an ESV operator. There is no indication that the Commission meant to sweep into the analysis all the various ways that use of one portion of the spectrum can have the practical affect of rendering less usable other portions of the spectrum that are not receiving interference, a consideration that can affect both FS and ESV operators, and whose impact depends on the circumstances of each individual case. The FWCC requested that the language referring to "actually encumbered" spectrum be promulgated into the rules. FWCC Petition at 13. The Commission should deny this request because, for the reasons given above, the language would leave the rules open to multiple interpretations. Rather, the language should be clarified to indicate that it refers to scenarios in which more than 180 MHz of *ESV- coordinated* spectrum may actually encumber an FS link path.

ESV NPRM,  $\P$  79.

<sup>&</sup>lt;sup>24</sup> Indeed, the Commission explicitly rejected limiting ESV operations to a specific portion of the C-band, *ESV Order*, ¶ 42, which is essentially the only way to guarantee such a reservation of spectrum.

be available to FS operators for new links.<sup>25</sup> By capping the amount of spectrum that can be coordinated by an ESV, the Commission responded to the FS community's concern that ESVs would, for example, seek to coordinate full-band, full-geostationary arc access.<sup>26</sup> The limits, as applied to spectrum actually coordinated by ESV operators, achieve the Commission's goal.<sup>27</sup>

At bottom, the Commission's spectrum/satellite limitations are necessarily somewhat arbitrary, and could be debated endlessly. However, those limitations, in the context of the coordination regime adopted by the Commission, represent a balanced approach that allows operation of ESV in the C-band, while fully protecting existing FS links and safeguarding spectrum for FS system expansion. The Commission should reject the FWCC's invitation to reopen that debate to look into the all the various incidental impacts any given coordination might have. As demonstrated above, those impacts are far less severe than portrayed by FWCC, can be felt by both FS and ESV operators alike, and depend on the circumstances of each case.

C. The Commission Should Not Reverse Its Decision to Permit C-Band ESV in U.S. Waters, Nor Raise its Vessel Size Limitations.

The FWCC urges the Commission to reverse its decision and rules regarding C-band ESV in the ESV Order, and instead to restrict ESVs to Ku-band

ESV Order,  $\P\P$  39-40; see also ESV NPRM,  $\P$  80.

<sup>&</sup>lt;sup>26</sup> ESV NPRM, ¶ 81.

For the same reason, the Commission should not reconsider its rejection of the FWCC's proposal to require ESV operators to coordinate only the spectrum they will "actually use." See FWCC Petition at 10. The ESV Order fully addressed the Commission's reasons for that decision, which are consistent with the Commission's approach in other analogous proceedings. ESV Order, ¶ 44.

frequencies in U.S. waters.<sup>28</sup> In the alternative, the FWCC requests the Commission to raise the minimum size for C-band vessels to at least 5,000 gross tons.<sup>29</sup>

As demonstrated above, the FWCC's assessment of the impact of C-band ESV links on FS operations is seriously flawed, and provides no reason for the Commission to reopen these issues. Moreover, as the Commission recognized, the C-band satellite option has advantages over the Ku-band in terms of accessibility, reliability, coverage, and weather-related attenuation. Eliminating the C-band satellite option for ESVs on coastal and inland vessels will deny customers who employ C-band satellites on the open seas the advantage of using a single type of terminal and a single satellite transponder to serve their needs, resulting in "higher cost service and inefficient use of spectrum," as well as interruption of service. These consequences would harm competition in the ESV market, to the detriment of consumers. The Commission should continue to rely on the extensive analysis that supported its decisions in the ESV Order, and deny the FWCC's requests to eliminate or reduce C-band service near coasts and inland waterways.

# II. THE COMMISSION SHOULD PERMIT ESVs TO OPERATE AT HIGHER OFF-AXIS POWER LEVELS CONSISTENT WITH THE COORDINATED PARAMETERS OF THE SERVING SATELLITES.

Intelsat supports Boeing's request that the Commission reconsider its decision to limit U.S.-licensed ESV operations to off-axis equivalent isotropically

<sup>&</sup>lt;sup>28</sup> FWCC Petition at 6.

<sup>&</sup>lt;sup>29</sup> *Id.* at 8.

<sup>&</sup>lt;sup>30</sup> *ESV Order*, ¶ 16.

<sup>&</sup>lt;sup>31</sup> *Id.*,  $\P$  17.

radiated power ("EIRP") density levels derived from the Commission's two-degree spacing limits, regardless of the coordinated parameters of the serving satellite.<sup>32</sup> As discussed below, the Commission's rules penalize the quality of service of U.S.-licensed ESV or hub operations in scenarios in which those limits are not required to prevent interference to any other operations.<sup>33</sup> Importantly, unlike other of the Commission's technical parameters applicable to ESVs, the off-axis EIRP levels are *not* meant to protect FS stations, but only adjacent FSS satellites that are, by definition, protected by the terms of their coordination agreements.<sup>34</sup> The Commission's rules thus create a regulatory disparity that serves no technical purpose.

As explained by Boeing, the Commission's discussion of this issue in the *ESV Order* does not provide any rationale for the decision not to permit power levels more consistent with coordination parameters, even in the case of non-U.S. licensed satellites not operating in a two-degree spacing environment.<sup>35</sup> In particular, the

While Boeing's discussion focuses on the Ku-band, the rationale for the proposal and the technical considerations involved are equally applicable to the C-band, and Intelsat urges the Commission to incorporate Boeing's proposal into its rules for both bands.

Much of the rest of the world employs three-degree spacing. The off-axis limits developed by the ITU and contained in Resolution 902 are based on a three-degree environment. See ESV Order, ¶14, n.49, and ¶55.

See ESV Order, ¶¶ 12, 55. It is important to note that Intelsat's international fleet of FSS satellites is therefore one of the intended beneficiaries of the Commission's limits. Intelsat relies for protection of these satellites on the individual coordination agreements it reaches with adjacent satellite operators. Such agreements increase system flexibility (as compared to generic pre-set limits), and, where possible, satellite operators should be permitted to employ such flexibility to increase the spectrum efficiency of ESV operations.

Boeing's proposal applies to ESV licensing for communication with individual satellites on a case-by-case basis, outside the scope of ALSAT authority (which would continue to require compliance with the Commission's limits). Boeing Comments at 5-6, 12. To grant such individual authority, the Commission should require a demonstration of compliance with the

Commission does not address at all why it has departed from its practice in similar circumstances of permitting such flexibility in both the C-band and Ku-band when there is no adverse impact on adjacent coordinated satellites.<sup>36</sup>

Furthermore, the Commission's explanation appears to address a narrow range of circumstances. The Commission's references to "U.S.-licensed FSS space station operations" and operation "with satellites licensed by the Commission" appear to indicate that the Commission was framing the issue only in terms of communication with U.S.-licensed satellites, or those routinely licensed via ALSAT authority. 38

off-axis EIRP limits set forth in ITU-R Resolution 902 (WRC-03) ("Resolution 902"), and a certification from the operator of the subject satellite stating that the ESV operations will conform to the applicable intersystem coordination constraints. *Id.* at 9, 14-16. For satellites in a two-degree spacing environment, such operation should be subject to an additional technical showing and the rights of future licensees to require two-degree compliant operations. *Id.* at 4, 13-14.

For example, the Commission's rules permit earth stations subject to blanket-licensing rules to operate with technical parameters that differ from the routine licensing provisions, in the C-, Ku-, and Ka-bands, so long as there would be no adverse interference impact on adjacent satellite operations. See 47 C.F.R. §§ 25.134(a)(2); 25,134(b); 25.138(b). In addition, rules were recently adopted to streamline procedures for earth stations of smaller-than-routine size or higher-than-routine power levels if the operator obtains a certification from the satellite operator indicating that the satellite has been coordinated to allow such operations. See 2000 Biennial Regulatory Review – Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations, Fifth Report, IB Docket No. 00-248, FCC 05-63, rel. March 15, 2005 ("Part 25 Streamlining 5th R&O"), ¶¶ 3, 28, 52, 65. The Commission noted in that proceeding, for example, that "if a non-routine earth station operator can successfully coordinate its operations with a [higher-than-routine power level], then we see no reason to preclude the earth station from operating at that power level with the particular target satellite that has been coordinated." Id., ¶ 65

ESV Order, ¶ 101. As noted by Boeing, this language is also unclear in its context. Boeing Comments at 4, n.11.

See Boeing Comments at 9-10.

The Commission's explanation does not appear to take into account scenarios that can occur in the particular context of ESVs, such as an earth station on a U.S.-registered vessel in a distant sea communicating with a non-U.S.-licensed satellite.<sup>39</sup> In such a situation, there is no reason not to allow the earth station to use a higher power level, so long as the power level is consistent with the coordination agreement for the satellite, or Resolution 902, whichever is more constraining. To not allow such operation unnecessarily limits the quality of service on the U.S. vessel, and creates a disparity with non-U.S. licensed vessels using the same service in the same locality. There is no technical difference between the two cases. The fact that a vessel is U.S.-registered should not impose a penalty that results in less operational flexibility for the ESV operator serving that vessel.

Similarly, use of a U.S. hub should not lead to disparity in the services that can be provided to ESVs. It is understandable that the Commission seeks to impose some of its ESV regulations on shipboard communications with a U.S. hub, no matter where the ship is registered. In this way, the Commission ensures protection of FS stations when such ships are in U.S. waterways. However, the off-axis EIRP limits are *not* meant to protect FS stations; they protect adjacent satellites. There is no danger to any U.S. operator, satellite or terrestrial, in allowing use of higher off-axis power levels, so long as those power levels are consistent with the coordination conditions of adjacent satellites.<sup>40</sup>

As noted by Boeing, global U.S.-licensed ESV operations will certainly require use of foreign satellites not on the Permitted Space Station List. Boeing Comments at 6, n.16.

Intelsat agrees with Boeing that the Commission should clarify in the rules themselves that the off-axis EIRP density levels are aggregate limits that must be met taking into account all simultaneously transmitting ESVs. Boeing Petition at 16-18. Intelsat also agrees with the Commission and Boeing that, in the case of an equal division of power among all

The ultimate goal of the Commission's rules should be to ensure that adjacent satellite networks operate satisfactorily without causing excess interference to each other. The operational conditions necessary to meet that goal are captured in the relevant intersystem coordination agreements, and satellite operators, including Intelsat, rely on those individually-tailored agreements for the protection of their satellites.

Therefore, the Commission should not impose the two-degree compatibility envelope on ESVs communicating with satellites for which that restriction is unnecessary, but should allow licensing of individual satellites as points of communication for ESVs, outside the ALSAT context, in accordance with the relevant coordination conditions for such satellites.<sup>41</sup>

simultaneously transmitting terminals (as with CDMA, for example), the EIRP density limit on each individual transmitter would be reduced by a factor of 10 log (N), in dB, where N is the number of transmitters. See ESV Order, ¶ 55, n.154; Boeing Petition at 17. This approach will be valid in all cases where the user bit rate is chipped through a variable rate so as to always result in a uniform spread bandwidth. As Boeing indicates, however, equal division of power should not be required, and in such cases the Commission's rules should allow other appropriate methodologies to be used. Boeing Petition at 18. In such cases, the Commission should require that the application contain a detailed explanation of the methodology and a clear demonstration that it will ensure compliance with the aggregate limits at all times, so that potentially-affected satellite operators can evaluate the approach and raise any concerns when the application is placed on public notice.

These considerations should apply not only to ESV uplink interference, but also to ESV downlink protection. PanAmSat has requested clarification on the protection status of ESV downlinks *vis-à-vis* other FSS downlinks in both the C-band and the Ku-band. PanAmSat Petition at 8-9. Intelsat believes that the intent in the *ESV Order*, and the correct approach, is to treat ESVs, as an application of the FSS, as co-primary with other FSS operations, and therefore entitled to protection from other space stations. Intelsat agrees with PanAmSat's proposal to limit that protection to that afforded other FSS earth stations conforming to the referenced patterns defined in Sections 25.209(a) and (b) of the Commission's rules, *id.* at 9, but only for routine-licensing in the ALSAT context. For the reasons given above, ESV operators should not be limited in their flexibility to coordinate with satellite operators for better protection, when actual satellite spacing or other technical considerations permit.

- III. THE COMMISSION SHOULD CONTINUE TO APPLY OFF-AXIS EIRP DENSITY LIMITS TO ESV OPERATIONS, AND CONSIDER FURTHER STEPS TO MAXIMIZE ESV FLEXIBILITY CONSISTENT WITH THE PROTECTION REQUIREMENTS OF ADJACENT FSS SATELLITES.
  - A. The Commission Should Reject PanAmSat's Proposal to Eliminate the Off-Axis EIRP Density Limits in Favor Of Separate Requirements On Off-Axis Antenna Gain and Power Density at the Input of the Earth Station.

Intelsat disagrees with PanAmSat's argument that the off-axis EIRP density limits should be replaced by separate limits on (1) the power density at the input of the earth station antenna and (2) the off-axis antenna gain. The off-axis EIRP density, which represents the sum of these two parameters, is the earth station parameter that determines the amount of uplink interference caused to an adjacent satellite. As the Commission recognized in the *ESV Order*, there is absolutely no reason from an interference standpoint for placing separate limitations on the antenna input power and off-axis antenna gain. PanAmSat's proposal would serve only to limit ESV operator flexibility and discourage application of technical advances.

Indeed, PanAmSat's arguments are not based on interference or other technical considerations. Rather, PanAmSat's proposal appear to stem solely from concern that the Commission's approach for ESVs is different from that applied in other contexts, and that ESVs might enjoy flexibility that other satellite operators do not.<sup>45</sup> However, because the Commission's off-axis EIRP envelope approach does not raise any

See PanAmSat Comments at 1, 4-6.

<sup>&</sup>lt;sup>43</sup> *ESV Order*, ¶ 14.

<sup>&</sup>lt;sup>44</sup> Id.

<sup>&</sup>lt;sup>45</sup> PanAmSat Comments at 4.

interference concern, PanAmSat's reason provides no justification for change of those rules. If anything, PanAmSat's concern should lead to reconsideration of the rules applicable in other satellites contexts. In fact, the Commission has proposed such a change for conventional C-band and Ku-band FSS operators, and that proposal is currently being examined in a separate Commission proceeding.<sup>46</sup>

# B. The Commission Should Not Reinterpret the Off-Axis EIRP Density Envelope to Include the Effects of Mispointing.

ARINC and PanAmSat argue that the Commission should interpret the current off-axis EIRP density envelope as including the effects of mispointing.<sup>47</sup>

However, implicit in their arguments is the assumption that mispointing was already taken into account in the derivation of the Commission's envelope. This is not the case, and the proposal should be rejected on that basis.

The derivation of the off-axis EIRP envelopes adopted in the *ESV Order* did not take into account pointing error. Those envelopes represent the addition of the maximum power density levels at the input of the transmit antenna and the antenna off-axis gain envelope specified in the Commission rules.<sup>48</sup> Therefore, the off-axis EIRP

See 2000 Biennial Regulatory Review – Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations, Sixth Report and Order and Third Further Notice of Proposed Rulemaking, IB Docket No. 00-248, FCC 05-62, rel. March 15 2005 ("Part 25 Streamlining 6th R&O" and "Part 25 Streamlining 3th Further Notice"), ¶¶ 1, 72-92.

ARINC Petition at 1 (arguing that the Commission should eliminate the mispointing limitations and consider mispointing limited by the off-axis EIRP density envelope); PanAmSat Petition at 6-8 (arguing that, in evaluating compliance with the envelope, mispointing must be assumed).

See ESV Order, ¶ 55 ("The limitations we set forth today are a direct result of combining Section 25.209, which sets forth antenna envelope limitations, and Section 25.212(d), which sets forth the constraints on power density delivered to the antenna."). See also id., ¶ 99.

density envelopes are associated with the main beam axis of the transmit antenna (*i.e.*, the direction the antenna is actually pointing), rather than the actual direction of the satellite as seen from the transmit antenna.<sup>49</sup> In other words, the envelopes govern the performance of the antenna, but say nothing about the direction it is pointed.<sup>50</sup> For this reason, pointing accuracy is governed by separate mispointing limits in the Commission's ESV rules.<sup>51</sup>

If, as proposed by ARINC and PanAmSat, the envelopes were now to be interpreted to themselves limit mispointing variations, the overall off-axis constraints on ESVs would be increased beyond those already determined in the *ESV Order* to protect adjacent FSS satellites. The Commission should reject this proposal. 52

The same is true of the envelopes contained in Resolution 902. The off-axis limits specified in Annex 2 of that Resolution are defined as a function of the angle from "the main-lobe axis of an earth-station antenna." Resolution 902, Annex 2. The ± 0.2° mispointing limitation specified in Resolution 902, on which the Commission's mispointing limit is explicitly based, see ESV Order, ¶¶ 58,103, constitutes an independent requirement. Therefore, neither the Resolution 902 nor the Commission off-axis EIRP envelopes incorporates pointing error considerations.

Indeed, if this were not the case, mispointing would not have become an issue in this or analogous cases. See Part 25 Streamlining 6<sup>th</sup> R&O, ¶¶ 4, 15-22 (adopting a conservative antenna pattern envelope based on the fact that mispointing can cause additional increase in antenna gain toward a neighboring satellite); Part 25 Streamlining 3<sup>rd</sup> Further Notice, ¶¶ 76-78 (applying the same assumption in proposing an off-axis EIRP density envelope).

<sup>&</sup>lt;sup>51</sup> See 47 C.F.R. §§ 25.221(6),(7); 25.222(6),(7).

Intelsat also disagrees with ARINC's suggestion that the Commission's shutdown rules should be removed if mispointing is incorporated into the envelope. ARINC Petition at 2, n.1.

# C. The Commission Should Incorporate Into the ESV Rules Approaches Recently Embraced in the *Part 25 Streamlining* Proceeding.

As the Commission has stated, one of its goals in this proceeding is to provide ESV operators maximum flexibility in implementing the required protection of adjacent FSS satellites.<sup>53</sup> In furtherance of this goal, Intelsat urges the Commission to consider extending the start of the off-axis EIRP density envelope, consistent with conclusions recently reached in the Commission's *Part 25 Streamlining* proceeding. In that proceeding, in order to better accommodate smaller earth station dish sizes, the Commission decided to begin the C- and Ku-band antenna gain pattern envelopes at 1.5°, instead of the 1.0° (C-band) and 1.25° (Ku-band) starting points of the prior rules.<sup>54</sup> The Commission also proposed to use the 1.5° starting point for any off-axis EIRP density envelopes that it might adopt in that same proceeding.<sup>55</sup> The Commission found that such adjustments were possible without violating the protection requirements of adjacent FSS satellites.<sup>56</sup>

The same general approach, *i.e.*, extending the angle at which the envelope starts, should be applied to the case of the ESV off-axis EIRP density envelope. This would further the consistency of Commission rules, and facilitate use of smaller ESV antennas, while still ensuring protection of adjacent satellites. As the Commission has noted in the instant proceeding, any rules adopted in the *Part 25 Streamlining* 

<sup>&</sup>lt;sup>53</sup> ESV Order, ¶ 14.

Part 25 Streamlining  $6^{th}$  R&O, ¶¶ 22, 25.

Part 25 Streamlining  $3^{rd}$  Further Notice, ¶ 78.

Part 25 Streamlining  $6^{th}$  R&O, ¶ 22.

proceeding could also apply to ESV operations.<sup>57</sup> Given that actions were just taken in that proceeding that could usefully be applied to ESVs, the Commission should give consideration to making conforming changes in the instant rules.<sup>58</sup>

Consistent with that approach, the Commission could safely extend the start of the ESV off-axis EIRP mask to 1.5°. However, in the particular case of ESVs, which are subject to a specific mispointing limitation, a variation on that approach would be more appropriate.

In the *Part 25 Streamlining* analysis, the 1.5° starting point was not intended to capture mispointing variation, but was adopted as a conservative limit to allow for the additional possibility of mispointing.<sup>59</sup> The amount of mispointing that could occur was not quantified, but the Commission considered the potential impact of

<sup>&</sup>lt;sup>57</sup> ESV NPRM, ¶ 53, n.92.

Although the Commission may choose to consider this proposal in the *Part 25 Streamlining* or other proceeding, it is also important to address and clarify the issue in the instant proceeding, given the overlap of the subject matter. To the extent that the Commission may consider the topic "new facts" under Section 1.429(b) of the Commission's rule, those rules permit consideration of new facts in cases of changed circumstances, or where consideration is in the public interest. The Commission's *Part 25 Streamlining 6<sup>th</sup> R&O* and *Part 25 Streamlining Further Notice*, in which the new approach to off-axis antenna patterns and EIRP envelopes was adopted and proposed, respectively, were released *after* the deadline for filing Petitions in this matter. Circumstances have therefore changed since the last opportunity to present them to the Commission. In addition, it would be in the public interest to make the rules for ESVs as consistent as possible with the rules for other C-band and Kuband earth stations. *See* PanAmSat Petition at 4 (arguing that, other than the shutdown requirement, the standards should be the same).

The Commission concluded that it could start the antenna gain pattern envelope at 1.8° off-axis, if there were no possibility of pointing error. Part 25 Streamlining 6<sup>th</sup> R&O, ¶¶ 16, 22, n.71. Taking into account the possibility of pointing error (but without assigning a numerical factor for such error), the Commission decided to begin the C- and Ku-band antenna gain pattern envelopes at 1.5°. Id., ¶ 22.

0.3°, 0.4°, and even 0.5° of mispointing.<sup>60</sup> In the case at hand, mispointing is limited to 0.2°, and there is therefore no need to be as conservative in selecting the start of envelope, so long as the mispointing limit is enforced. One approach, therefore, would be to re-derive the ESV off-axis EIRP mask to take into account the variability that 0.2° mispointing can cause, extend the start of the mask by an amount consistent with that mispointing assumption, and then, to ensure that the possibility of greater mispointing does not undermine the assumption, apply the Commission's shutdown requirement to any violation of the resulting mask.

According to this approach, the Commission's envelope would first be adjusted to take into account the incorporation of the  $\pm 0.2^{\circ}$  mispointing limit. An ESV conforming to the uplink off-axis EIRP density envelopes contained in the *ESV Order*, and meeting the  $\pm 0.2^{\circ}$  pointing accuracy requirement, would radiate, in the worst case, an uplink off-axis EIRP density, as measured from the axis linking the ESV and the satellite with which it operates, the equivalent of the envelope of the *ESV Order* shifted in the positive direction by  $0.2^{\circ}$ . Such adjustment does not increase at all the levels of off-

For C-band:

Maximum EIRP Density	Unit		Off-Axis Angle
$26.3 - 25 \log (\theta - 0.2)$	dBW/4kHz	for	$1.2^{\circ} \le \theta \le 7.2^{\circ}$
5.3	dBW/4kHz		7.2° < θ ≤ 9.4°
$29.3 - 25 \log (\theta - 0.2)$	dBW/4kHz		9.4° < θ ≤ 48.2°

<sup>&</sup>lt;sup>60</sup> See Part 25 Streamlining Proceeding 6<sup>th</sup> R&O, ¶ 22.

In other words, if the ESV Order envelope allows an uplink off-axis EIRP density of X dBW/4kHz at an off-axis angle φ as measured from the main beam axis of the ESV transmit antenna, and Y dBW/4kHz at an off axis angle equal to (φ – 0.2°) measured from the same reference, the ESV antenna could radiate Y dBW/4kHz in the direction φ as measured from the axis linking the ESV to the operating satellite, and still be compliant with the envelope of the ESV Order. This results in the following envelopes:

axis EIRP density permitted under the rules adopted in the ESV Order, and should therefore be considered entirely consistent with the requirement for  $\pm 0.2^{\circ}$  pointing accuracy.

The Commission would next extend the start of the mask consistent with the conclusions reached in the *Part 25 Streamlining* proceeding. If the ESV envelope is re-derived to include mispointing within the applicable limits, and if, as noted above, the ESV operator would be subject to a strict shutdown requirement if the envelope is exceeded for any reason,<sup>62</sup> in Intelsat's view, the start of the ESV envelope could begin at

-12.7 $dBW/4kHz$ $48.2^{\circ} < \theta \le 180^{\circ}$			 
	-12.7	l dBW/4kHz	48.2° < θ ≤ 180°

#### And for Ku-band:

Maximum EIRP Density	Unit		Off-Axis Angle
$15 - 25 \log (\theta - 0.2)$	dBW/4kHz	for	$1.45^{\circ} \le \theta \le 7.2^{\circ}$
-6	dBW/4kHz		$7.2^{\circ} < \theta \le 9.4^{\circ}$
$18 - 25 \log (\theta - 0.2)$	dBW/4kHz		9.4° < θ ≤ 48.2°
-24	dBW/4kHz		48.2° < θ ≤ 180°

Where  $\theta$  is any angle in degrees from the axis linking the ESV to the satellite it operates with, along the geostationary arc.

See ESV Order, ¶¶ 58, 104; see also PanAmSat Petition at 3. In this case, the shutdown requirement would be recast so that it is an exceedence of the envelope conditions, and not any particular mispointing angle, that triggers the shut-down requirement. Whenever the combination of antenna input power, antenna pattern and pointing error is such that the envelope is exceeded, the obligation to cease transmissions would be triggered.

On a related point, Intelsat agrees with PanAmSat that ESV operators should be required to utilize an automatic antenna pointing mechanism and present in the application to be placed on public notice a technical showing that such mechanism is capable of achieving and maintaining the required antenna pointing accuracy. PanAmSat Petition at 2. The showing should describe the methodology by which the applicant will assess the required pointing accuracy, the steps it will take to identify an exceedence of the envelope, the actions it will take (*i.e.*, correction of pointing, reduction of power) to correct such an exceedence, and a detailed description of the mechanism it will use to shut down transmissions in case of violation of the envelope.

2.0°. This appears consistent with the analysis in the *Part 25 Streamlining* proceeding, which was necessarily conservative due to the unquantified nature of the mispointing in that case.  $^{63}$  It also is consistent with the Commission's  $\pm 0.2^{\circ}$  mispointing limitation, with the further advantage of eliminating the discrepancy in the current rules between the maximum mispointing of  $\pm 0.2^{\circ}$  combined with a shutdown requirement that is triggered only when mispointing reaches  $\pm 0.5^{\circ}$ . Intelsat urges the Commission to consider this approach in this or another appropriate proceeding.

## IV. THE COMMISSION SHOULD CLARIFY CERTAIN OTHER PROVISIONS OF ITS RULES.

Intelsat agrees with Boeing that the Commission should adopt uniformly the 125 km distance set forth in Resolution 902 for the Ku-band distance from the U.S. coastline within which foreign ESV operations must be conducted pursuant to a bilateral agreement with the United States, and not 300 km as specified in the *ESV Order*. The 300 km minimum distance adopted in the *ESV Order* is consistent with the distance specified in Resolution 902 for the C-band, but not for the Ku-band, and the Commission

Although the Commission found that it could start an antenna gain pattern envelope at 1.8° only if there were no possibility of pointing error, the Commission adopted 1.5° as the start of the mask taking into account 0.4-0.5° of mispointing, based on the existence of other compensating factors, such as the difference between topocentric and geocentric angles. See Part 25 Streamlining 6<sup>th</sup> R&O, ¶ 22. The same considerations apply here. Furthermore, as discussed above, the shutdown requirement would be strictly enforced. To avoid interruption of service, ESV operators would need to be conservative in controlling mispointing and power levels. Therefore, there is no need to also be unduly conservative in selecting the start of the mask, as was the case in the Part 25 Streamlining proceeding where mispointing was not strictly limited, nor included in the definition in the mask, and was, in fact, unbounded.

In the rules adopted in the ESV Order, while the maximum mispointing is specified as ± 0.2°, cessation of transmissions is not required until the mispointing exceeds ± 0.5°. ESV Order, ¶¶ 58, 104; 47 C.F.R. §§ 25.221(a)(7), 25.222(a)(7). See also PanAmSat Petition at 3.

Boeing Petition at 22-23.

provides no reason for not following the Resolution 902 approach, <sup>66</sup> especially given that the United States supported the 125 km distance for Ku-band at WRC-03.<sup>67</sup>

Intelsat also agrees with MTN that the Commission's provision regarding coordination with off-shore FS stations contains certain ambiguities, and disparities with the provisions of Resolution 902.<sup>68</sup> As noted by MTN, the provision is not explicitly limited to off-shore FS installations near the U.S. coast, nor to U.S.-licensed FS operations, and does not affect non-U.S. ESV operators, due to a lack of a similar provision in Resolution 902.<sup>69</sup> The Commission should clarify the text of the rules, most importantly to indicate that the coordination requirements do not apply to non-U.S. offshore stations.

Finally, Intelsat supports MTN's request for reconsideration of the provision requiring immediate cessation of operations of coordinated ESVs during the 30-day public notice period if any objection is received to the coordination.<sup>70</sup> As noted by MTN, by the time of the public notice, a coordination agreement ostensibly covering all affected FS licensees will have been reached.<sup>71</sup> Complete cessation of transmission in any frequency, and over the entire locality, for an indefinite period, is not required to

<sup>&</sup>lt;sup>66.</sup> ESV Order, ¶¶ 127-128.

See Document WRC03-C-0012, "United States of America, Proposals for the Work of the Conference," text related to Agenda Item 1.26.

<sup>&</sup>lt;sup>68</sup> See MTN Petition at 5-6; 47 C.F.R. 25.221(e).

<sup>69</sup> MTN Petition at 6.

<sup>&</sup>lt;sup>70</sup> *Id.* at 4.

<sup>&</sup>lt;sup>71</sup> *Id*. at 4.

protect a potentially-affected FS link that may have been unintentionally overlooked. The rule should require that any objecting party describe with specificity the potential harm to its FS station, and any shutdown requirement should be narrowly tailored to address the specific interference concern raised.<sup>72</sup>

#### V. CONCLUSION

For the above reasons, the Commission should deny the FWCC Petition, as well as certain requests of PanAmSat and ARINC. The Commission should adopt certain proposals of PanAmSat, Boeing and MTN, as identified and discussed herein.

Respectfully Submitted,

202-944-6800

Intelsat, Ltd.

Phillip L. Spector
Executive Vice President and General Counsel
Intelsat, Ltd.
Wellesley House North, 2nd Floor
90 Pitts Bay Road
Pembroke, HM 08
Bermuda
441-294-1650

April 21, 2005

By: /s/ Susan H. Crandall
Susan H. Crandall
Assistant General Counsel
Intelsat Global Service Corporation
3400 International Drive, N.W.
Washington, D.C. 20008

See generally, Part 25 Streamlining  $5^{th}$  R&O, ¶ 73.

### **CERTIFICATE OF SERVICE**

I, Derrick Johnson, do hereby certify that on this 21st day of April, 2005, I sent via electronic mail a true and correct copy of the foregoing Opposition and Comments of Intelsat, Ltd. to the following:

R. Craig Holman
Counsel
The Boeing Company
Connexion by Boeing
P.O. Box 3707, MC 14-07
Seattle, WA 98124-2207
(206) 655-5399
craig.holman@boeing.com

Mitchell Lazarus
Fletcher, Heald & Hildreth, P.L.C.
1300 North 17th Street, 11th Floor
Arlington, VA 22209
703-812-0440
Counsel for the Fixed Wireless
Communications Coalition
Lazarus@fhhlaw.com

Raul R. Rodriguez
Stephen D. Baruch
Leventhal Senter & Lerman PLLC
2000 K Street, N.W.
Suite 600
Washington, DC 20006
Counsel for Maritime Telecommunications
Network, Inc.
rrodriguez@lsl-law.com
sbaruch@lsl-law.com

Philip L. Malet
Carlos M. Nalda
Lee C. Milstein
Steptoe & Johnson LLP
1330 Connecticut Avenue, NW
Washington, DC 20036
(202) 429-3000
Counsel for The Boeing Company
pmalet@steptoe.com
cnalda@steptoe.com
lmilstein@steptoe.com

John L. Bartlett
Carl R. Frank
1776 K Street, N.W.
Wiley Rein & Fielding LLP
Washington, D.C. 20006
(202) 719-7000
Counsel for ARINC Incorporated
cfrank@wrf.com
ibartlett@wrf.com

Joseph A. Godles
Goldberg, Godles, Wiener & Wright
1229 Nineteen Street, N.W.
Washington, D.C. 20036
(202) 429-4900
Counsel for Panamsat Corporation
jgodles@g2w2.com

Howard Griboff, Assistant Division Chief Policy Division International Bureau Federal Communications Commission 445 12<sup>th</sup> Street, SW Washington, DC 20554 Howard.Griboff@fcc.gov Paul Locke, Assistant Chief, Engineering Policy Division International Bureau Federal Communications Commission 445 12<sup>th</sup> Street, SW Washington, DC 20554 Paul.Locke@fcc.gov

/s/ Derrick Johnson
Derrick Johnson